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BIOLOGICAL EVALUATION OF THE MOUNTAIN PINE BEETLE IN LODGEPOLE PINE IN GRAND TETON NATIONAL PARK 1970

Prepared by: William H. Klein

William H. Klein
Entomologist, Section of Detection and Evaluation

M. C. GALBRAITH

Recommended by: _____

Marlin C. Galbraith
Chief, Division of Timber Management

G. A. Wells

Approved by: _____

Vern Hamre
Regional Forester

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The mountain pine beetle, Dendroctonus ponderosae Hopk. remained at a very high level in most areas of Grand Teton National Park during 1970 (Figures 6-9). The present infestation is the result of a general resurgence of beetle activity that was temporarily curtailed by an intensive suppression program that began in 1957 and ended in 1967. Once treatment was discontinued, beetle populations and tree killing increased at a rapid rate. In some areas, however, particularly near the untreated Teton Wilderness, treatment had little, if any, effect in preventing tree mortality (Figure 6). In adjacent Teton National Forest, the mountain pine beetle continued its downward trend and is now at a very low level.

The best index of the beetle's potential for increase and its subsequent destructiveness is a quantitative measure of stand structure. Stand structure is simply the constitution of a stand with respect to tree species, age, and diameter classes. We now know, for example, that the beetle prefers the larger diameter trees, disproportionate to their occurrence in the stand; that lodgepole stands containing a preponderance of large trees will suffer the heaviest volume losses; that total stand losses are greater at low elevations than at high elevations; and finally, and most important, the mountain pine beetle does not decimate lodgepole stands to the extent thought earlier. On the average, mortality will range between 25 and 30 percent of trees 5.0 inches in diameter and larger. The life of an untreated infestation runs seven to eight years with peak killing occurring the fifth or sixth year. If treatment was never undertaken in the Park, the infestation would have run its course several years ago.

During July 1970, stand structure data was obtained from five widely separated lodgepole stands in the Park. The data is summarized in Figures 1 through 5. In general it shows that:

1. The stands are principally lodgepole and are adequately stocked.

2. Mortality of lodgepole pine caused by the mountain pine beetle ranged from 15 to 20 percent of the stand. In most cases, more than half of the trees 11.0[1/] inches d.b.h. have already been killed by the mountain pine beetle. The larger trees sustained the heaviest mortality. Basal area of lodgepole pine was reduced by approximately 50 percent.

1/ Tree diameter (d.b.h.) was measured by 2-inch diameter classes. For example, the 12-inch class includes all diameters between 11.0 and 12.9 inches.

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3. The mountain pine beetle infestation in the Park has reached its peak and has already started to decline. (This is substantiated by subsequent evaluation data.)

4. When the infestation finally subsides (3 to 4 years from now), total lodgepole pine mortality should not exceed that found previously in similar stands; i.e., 25 to 30 percent of trees 5.0 inches and larger.

As an adjunct to the stand depletion cruises, evaluation surveys were conducted in nine areas throughout the infestation to determine the relative infestation level, the ratio of new attacks (1970) to old (1969), and brood stage and condition. This data is summarized below:

Area	Attacks In 1970	Attacks In 1969	Buildup Ratio 1/	Average Diameter of Trees Attacked In 1970	Average Diameter of Trees Attacked In 1969	Infestation Intensity 3/	Trend
Phelps Lake	65	60	1.1:1	13.7	16.2	H	Static
Whitegrass	48	55	0.9:1	9.8	10.0	H	Static
Cottonwood Creek	40	41	1:1	10.2	11.4	H	Static
Bradley Lake	5	11	2/	12.4	8.2	L	Decreasing
Timber Island	43	56	0.8:1	10.3	10.9	H	Decreasing
Spaulding Bay	16	15	1:1	8.3	9.9	M	Static
Signal Mountain #1	99	80	1.2:1	9.9	9.9	H	Increasing
Signal Mountain #2	126	112	1.1:1	10.0	10.9	H	Increasing
Pilgrim Creek	13	12	--	10.5	10.5	L	Static

1/ Ratio of 1970 attacked trees to those attacked in 1969; i.e., 65/60 = 1.1:1

2/ Counts too few to compute meaningful ratio.

3/ H=Heavy, M=Moderate, L=Light

In most areas the number of new (1970) attacks was equal to or less than the number of old (1969) attacks, indicating static to decreasing conditions.

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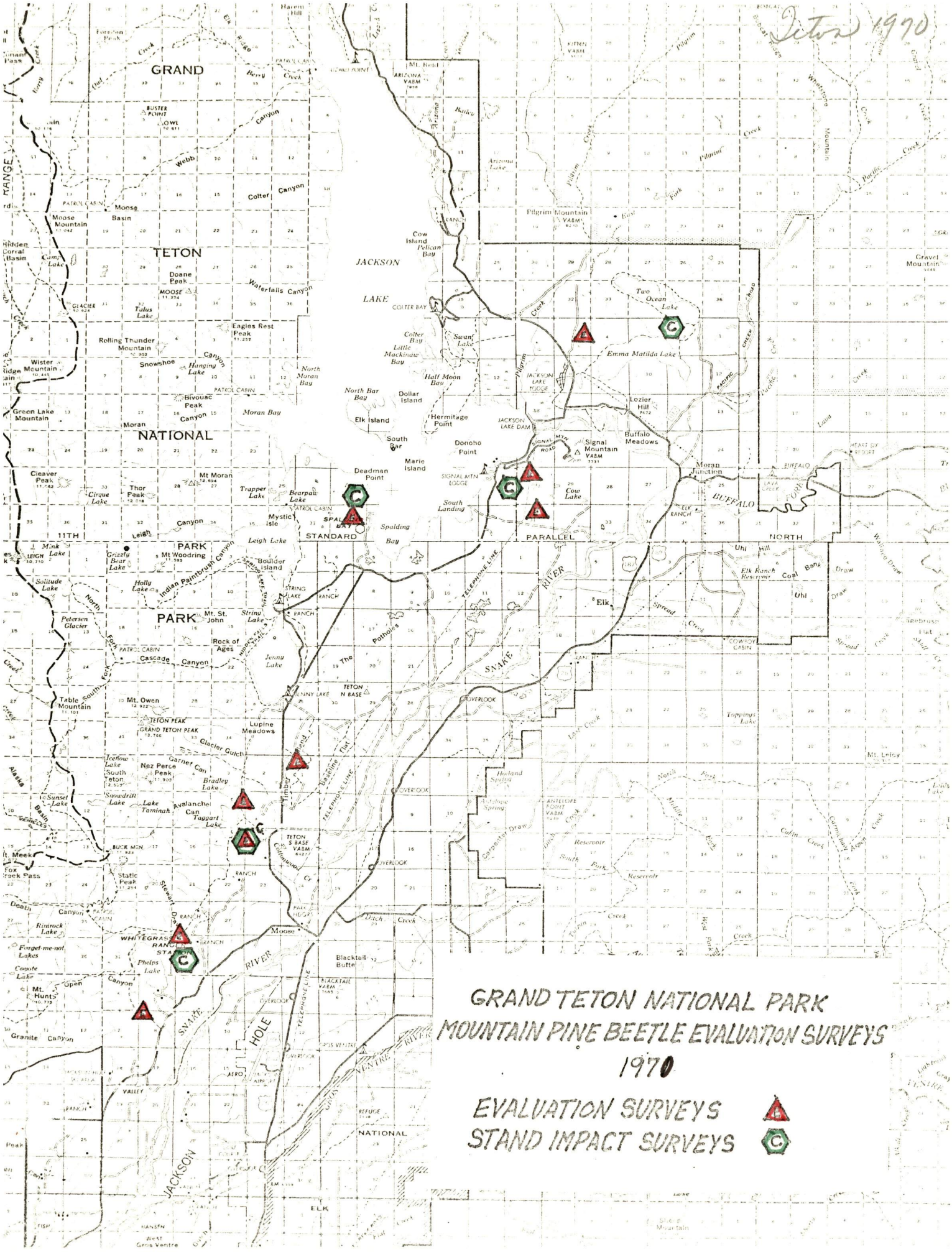
The only exceptions are the two areas near Signal Mountain which show a slight increase in the present infestation level. The reason for this becomes evident upon examination of Figure 4. There are still an abundant number of large diameter lodgepoles remaining (11.5 trees/acre in the 12-inch class and 5.5 trees/acre in the 14-inch class) to sustain heavy mortality for at least two more years. As many trees will be attacked in 1971 as were killed in 1970; then the rate of mortality should decline.

Insect broods were heavy in practically all of the trees examined. Brood stage, during the second week of October, varied from eggs to large larvae. No unusual incidence of parasites or predators were observed.

In summary, mountain pine beetle populations in the Park have reached their peak and are now on the decline. Tree killing will continue at a high level for the next one or two years, but at a decreasing rate. The net result will not be complete stand decimation. Rather, approximately 70 to 75 percent of the stand will remain, but the survivors will be the smaller trees. Most of the larger trees will be killed.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GRAND TETON NATIONAL PARK
MOUNTAIN PINE BEETLE EVALUATION SURVEYS
1970
EVALUATION SURVEYS
STAND IMPACT SURVEYS
JACKSON LAKE
TETON NATIONAL PARK
GRAND TETON NATIONAL PARK
STANDARD PARALLEL NORTH
11TH MERIDIAN
SNAKE RIVER
JACKSON HOLE
BUFFALO FORK
Mt. Moran
Mt. Owen
Grand Teton
Teton Peak
Mt. St. John
Mt. Woodring
Mt. Hunt
Static Peak
Rolling Thunder Mountain
Eagles Rest Peak
Cleaver Peak
Thor Peak
Table Mountain
Rimrock Lake
Signal Mountain
Jackson Lake Lodge
Colter Bay
Moran Junction
Elk Ranch Reservoir
Teton Base
Overlook
Ranch
Patrol Cabin
Lupine Meadows
Jenny Lake
String Lake
Leigh Lake
Phelps Lake
Two Ocean Lake
Emma Matilda Lake
Pilgrim Mountain
Gravel Mountain
Buffalo Meadows
Lozier Hill
Uhl Hill
Elk
Moose
Wilson
Jackson
Elk

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Figure 1. Graphic and statistical presentation of stand structure in several areas in Teton National Park, 1970.

Area	Diameter Class (In.)	Trees Per Acre: Live Lpp. (No.)	Live Lpp. (%)[1]	Dead Lpp. (No.)	Dead Lpp. (%)[1]	Live Other[2] (No.)	Live Other[2] (%)[1]	Total All Spp. (No.)	Total All Spp. (%)[1]
Whitegrass R.S.	6	52.5	21.6	10.0	4.1	45.0	18.5	107.5	44.2
	8	25.2	10.3	5.6	2.3	22.4	9.2	53.2	21.8
Basal Area/Acre ($Ft.^2$)	10	18.0	7.4	5.4	2.2	13.5	5.5	36.9	15.1
Live Lpp. 40.5	12	6.6	2.7	8.4	3.4	4.8	2.0	19.8	8.1
Dead Lpp. 24.0									
Other Spp.[2] 47.5	14	3.5	1.4	3.5	1.4	4.5	1.9	11.5	4.7
Total 111.5	16	1.2	0.5	1.6	0.7	0.4	0.2	3.2	1.4
	>16	0.3	0.1	2.7	1.1	8.4	3.5	11.4	4.7
SE %[3] 12.3									
Total		107.3	44.0	37.2	15.2	99.0	40.8	243.5	100.0

1/ Percent of total stand
2/ Douglas-fir, subalpine fir
3/ One standard deviation

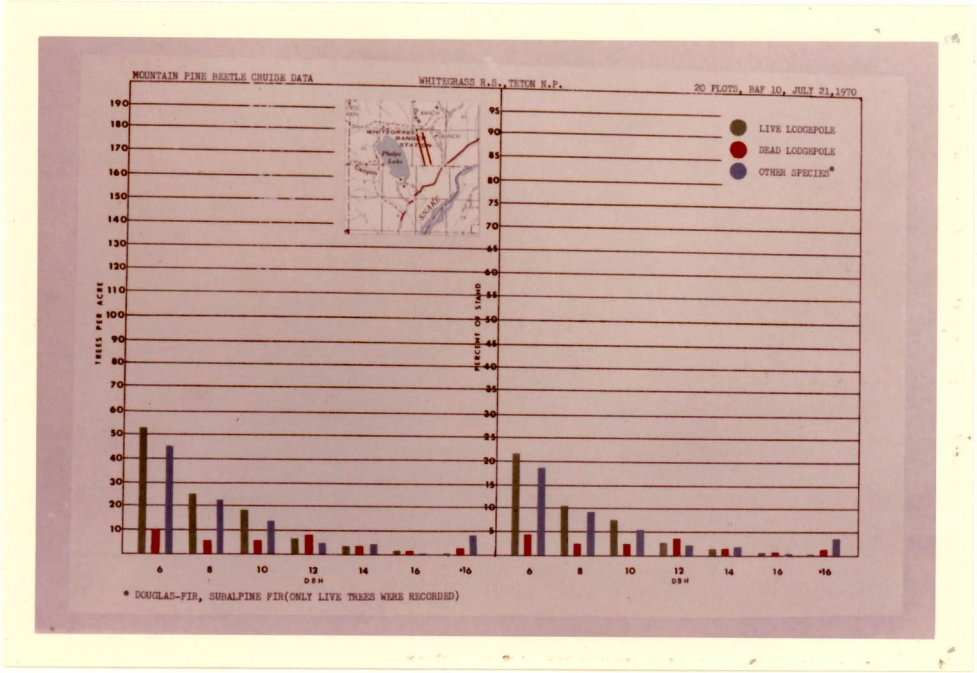

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Figure 2. Graphic and statistical presentation of stand structure in several areas in Teton National Park, 1970.

Area	Diameter Class (In.)	Trees Per Acre: Live Lpp. (No.)	Live Lpp. (%)[1]	Dead Lpp. (No.)	Dead Lpp. (%)[1]	Live Other[2] (No.)	Live Other[2] (%)[1]	Total All Spp. (No.)	Total All Spp. (%)[1]
Taggart Lake	6	65.0	27.8	2.5	1.1	17.5	7.5	85.0	36.4
	8	50.4	21.6	5.6	2.4	18.2	7.8	74.2	31.8
Basal Area/Acre ($Ft.^2$)	10	13.5	5.8	9.0	3.9	7.2	3.1	29.7	12.8
Live Lpp. 53.5	12	9.6	4.1	12.6	5.4	3.6	1.5	25.8	11.0
Dead Lpp. 27.0									
Other Spp.[2] 24.0	14	4.0	1.7	5.5	2.4	1.5	0.7	11.0	4.8
Total 104.5	16	0.4	0.2	0.8	0.3	1.2	0.5	2.4	1.0
	>16	1.5	0.6	1.5	0.6	2.4	1.0	5.4	2.2
SE %[3] 10.9									
Total		144.4	61.8	37.5	16.1	51.6	22.1	233.5	100.0

1/ Percent of total stand
2/ Douglas-fir, subalpine fir, Engelmann spruce
3/ One standard deviation

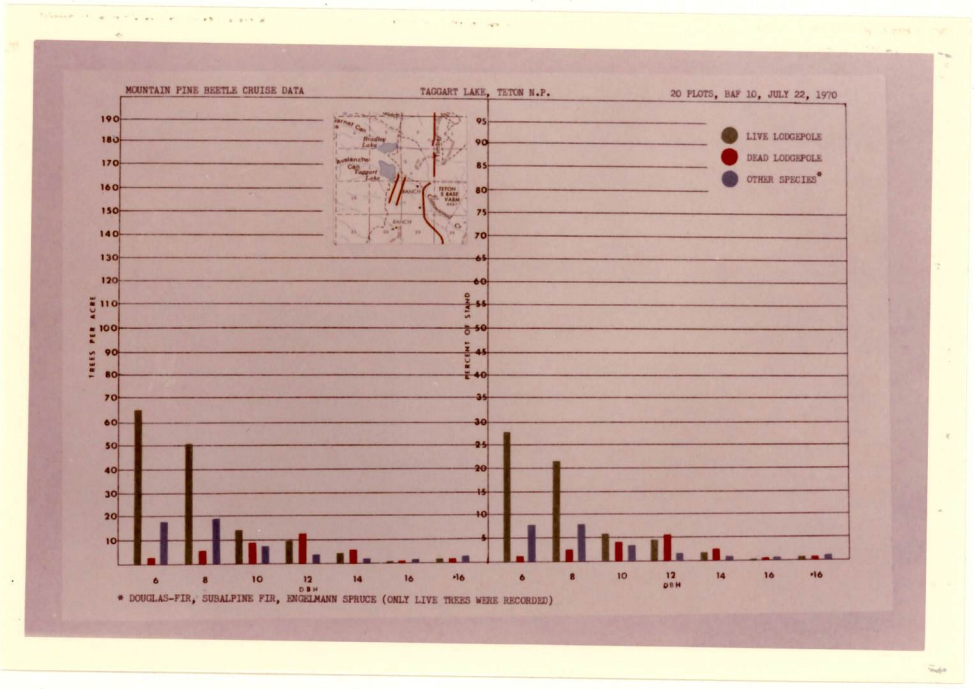
MOUNTAIN PINE BEETLE CRUISE DATA
TAGGART LAKE, TETON N.P.
20 PLOTS, BAF 10, JULY 22, 1970
LIVE LODGEPOLE
DEAD LODGEPOLE
OTHER SPECIES*
TREES PER ACRE
PERCENT OF STAND
DBH
* DOUGLAS-FIR, SUBALPINE FIR, ENGELMANN SPRUCE (ONLY LIVE TREES WERE RECORDED)

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Figure 3. Graphic and statistical presentation of stand structure in several areas in Teton National Park, 1970.

Area	Diameter Class (In.)	Trees Per Acre: Live Lpp. (No.)	Live Lpp. (%)[1]	Dead Lpp. (No.)	Dead Lpp. (%)[1]	Live Other[2] (No.)	Live Other[2] (%)[1]	Total All Spp. (No.)	Total All Spp. (%)[1]
Spalding Bay	6	92.5	35.2	2.5	1.0	35.0	13.3	130.0	49.5
	8	50.4	19.2	9.8	3.7	8.4	3.2	68.6	26.1
Basal Area/Acre ($Ft.^2$)	10	20.7	7.9	8.1	3.1	3.6	1.4	32.4	12.4
Live Lpp. 53.5	12	3.6	1.4	9.0	3.4	1.8	0.6	14.4	5.4
Dead Lpp. 30.5									
Other Spp.[2] 18.5	14	1.5	0.6	5.5	2.1	2.0	0.7	9.0	3.4
Total 102.5	16	0.4	0.2	0.8	0.3	1.6	0.6	2.8	1.1
	>16	0.3	0.1	4.8	1.8	0.6	0.2	5.7	2.1
SE %[3] 8.2									
Total		169.4	64.6	40.5	15.4	53.0	20.0	262.9	100.0

1/ Percent of total stand
2/ Subalpine fir
3/ One standard deviation

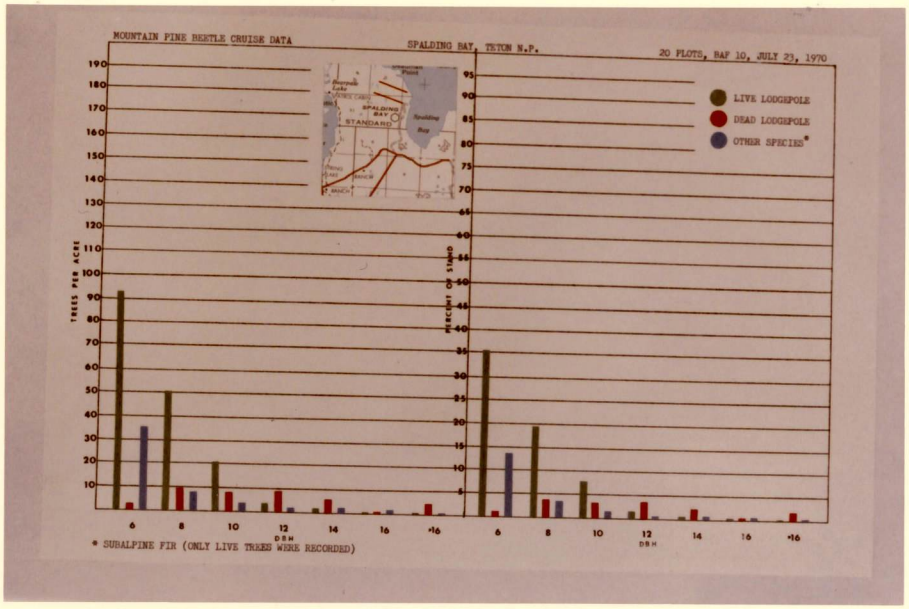

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Figure 4. Graphic and statistical presentation of stand structure in several areas in Teton National Park, 1970.

Area		Diameter Class (In.)	Trees Per Acre: Live Lpp. (No.)	Live Lpp. (%)[1]	Dead Lpp. (No.)	Dead Lpp. (%)[1]	Live Other[2] (No.)	Live Other[2] (%)[1]	Total All Spp. (No.)	Total All Spp. (%)[1]
Signal Hill		6	60.0	31.6	--	--	--	--	60.0	31.6
		8	40.6	21.4	4.2	2.2	--	--	44.8	23.6
Basal Area/Acre ($Ft.^2$)		10	32.4	17.0	14.4	7.6	1.8	0.9	48.6	25.5
Live Lpp.	61.5	12	11.5	6.1	4.8	2.5	--	--	16.3	8.6
Dead Lpp.	29.0									
Other Spp.[2]	1.0	14	5.5	2.9	9.0	4.7	--	--	14.5	7.6
Total	91.5	16	0.8	0.4	2.4	1.3	--	--	3.2	1.7
		>16	0.6	0.3	2.1	1.1	--	--	2.7	1.4
SE %[3]	9.3									
Total			151.4	79.7	36.9	19.4	1.8	0.9	190.1	100.0

1/ Percent of total stand
2/ Douglas-fir, subalpine fir
3/ One standard deviation

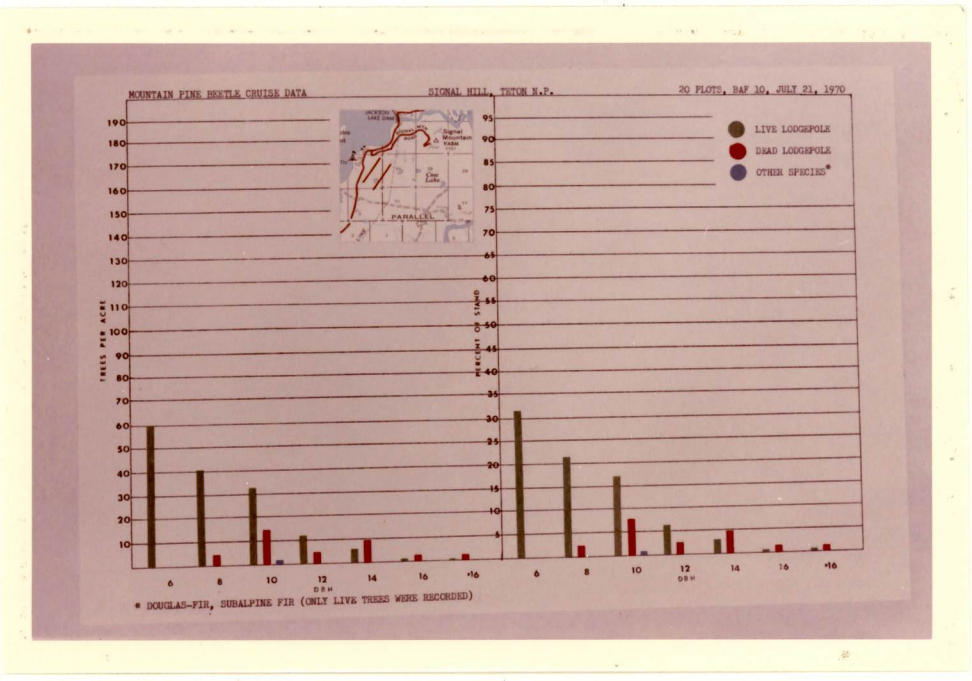

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Figure 5. Graphic and statistical presentation of stand structure in several areas in Teton National Park, 1970.

Area		Diameter Class (In.)	Trees Per Acre: Live Lpp. (No.)	Live Lpp. (%)[1]	Dead Lpp. (No.)	Dead Lpp. (%)[1]	Live Other[2] (No.)	Live Other[2] (%)[1]	Total All Spp. (No.)	Total All Spp. (%)[1]
Two Ocean Lake		6	45.0	20.0	--	--	10.0	4.4	55.0	24.4
		8	54.6	24.3	14.0	6.2	5.6	2.5	74.2	33.0
Basal Area/Acre ($Ft.^2$)		10	37.8	16.8	17.1	7.6	4.5	2.0	59.4	26.4
Live Lpp.	61.5	12	9.6	4.3	6.0	2.7	4.2	1.9	19.8	8.9
Dead Lpp.	30.0									
Other Spp.[2]	16.0	14	1.5	0.7	3.0	1.3	3.0	1.3	7.5	3.3
Total	107.5	16	0.8	0.4	4.0	1.8	0.4	0.2	5.2	2.4
		>16	0.9	0.4	1.5	0.7	1.2	0.5	3.6	1.6
SE %[3]	7.4									
Total			150.2	66.9	45.6	20.3	28.9	12.8	224.7	100.0

1/ Percent of total stand
2/ Douglas-fir, subalpine fir, Engelmann spruce
3/ One standard deviation

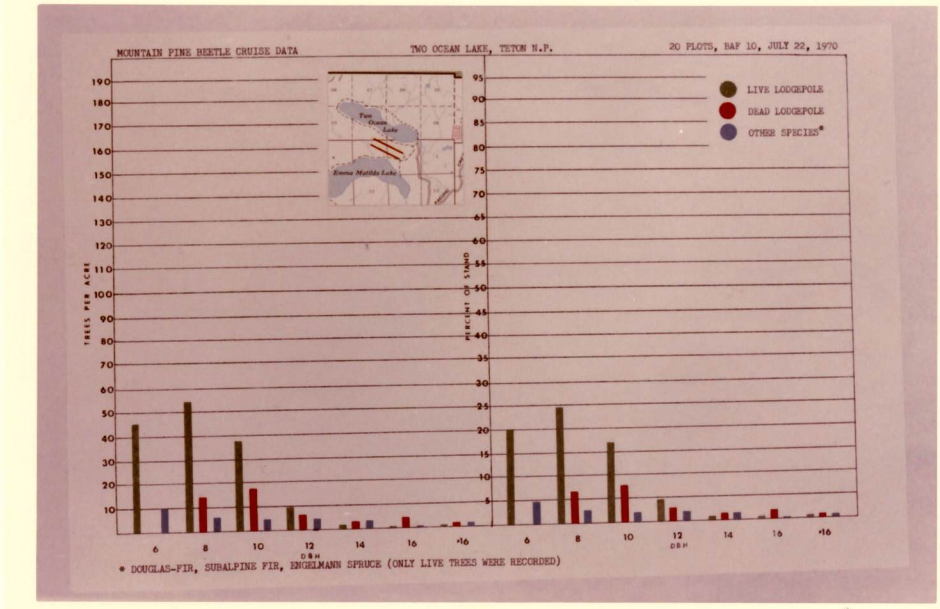
MOUNTAIN PINE BEETLE CRUISE DATA
TWO OCEAN LAKE, TETON N.P.
20 PLOTS, BAF 10, JULY 22, 1970
LIVE LODGEPOLE
DEAD LODGEPOLE
OTHER SPECIES*
TREES PER ACRE
PERCENT OF STAND
DBH
* DOUGLAS-FIR, SUBALPINE FIR, ENGELMANN SPRUCE (ONLY LIVE TREES WERE RECORDED)

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Figure 6. Aerial photograph of mountain pine beetle attacked lodgepole pine stand near Arizona Lake. This stand was treated.

Figure 7. Aerial photograph of Coulter Bay area. Coulter Bay Campground and Visitor Complex on left.

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Figure 8. Aerial photograph showing mountain pine beetle infestation on Elk Island in Jackson Lake.

Figure 9. Aerial view showing level of tree killing in Deadman Point area. Mt. Moran in upper left.